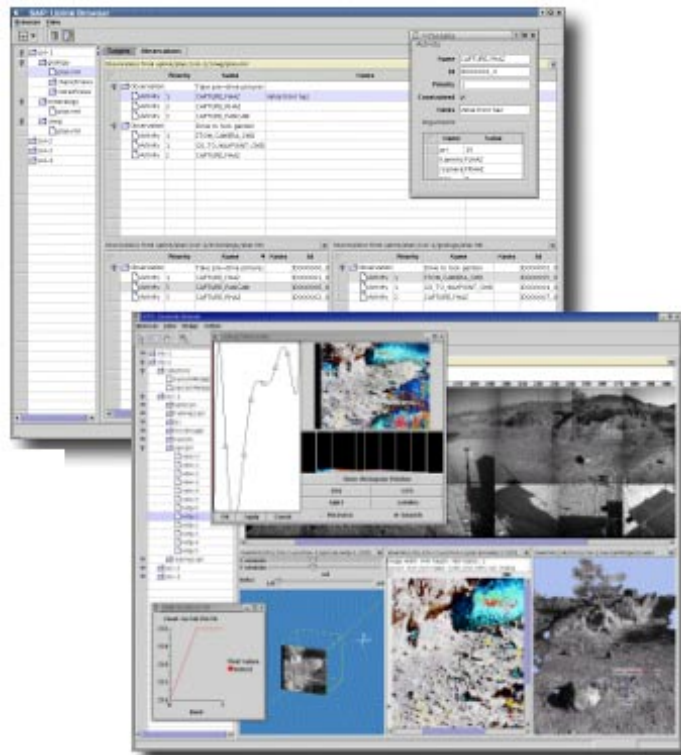


## *WITS: Web Interface for Telescience*

### **Tutorial for FIDO Adaptation**



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July 24, 2002  
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## **1 Introduction**

Welcome to the WITS for FIDO tutorial. The purpose of this tutorial is to guide a user through a typical WITS session for visualizing downlink FIDO data, selecting targets, and generating an uplink sequence. It is assumed that WITS is properly installed on the user's computer. This tutorial is intended for WITS running on both Windows2000 and Linux operating systems since the operation of WITS is almost identical for both platforms.

## **2 Starting WITS**

This section describes how to start WITS on your computer.

### **2.1 Starting WITS on Windows**

After downloading and running the Windows installer from the WITS website, there will be a WITS icon on your desktop and in your start menu. You can use either of these to start WITS. In your start menu, there is also an icon labeled “WITS (debug mode)”. If you start WITS using this icon, a console window will be opened that will display WITS messages that may be helpful if you are trying to provide information to the WITS developers about a problem you have encountered.

### **2.2 Starting WITS on Linux**

The WITS installation script prompted you for where you would like WITS to be installed on your computer. Common installation locations are in /var or in the user’s home directory. Change to the directory where you installed WITS. This directory has subdirectories called “bin”, “doc”, and “jre”. The “bin” directory contains two startup scripts, “WITS”, and “SAP”, either of which can be used to start the program. Change to the “bin” directory and type “./WITS” to start the program.

### **2.3 The WITS Login Dialog**

The first thing you will see when you start WITS is the WITS Login Dialog, shown in figure [2-1](#). The Login Dialog allows a user to enter their username and password. User names and passwords are not yet implemented. These will be implemented in future releases, so it does not matter at this time what user name and password are entered. Just leave these fields blank for now.

The Login Dialog also allows a user to select between different missions and databases that are installed on their computer. By default, WITS is installed with only one database, so these pull-down menus will only have one item in them for now.

Press the “Login” button to start WITS. This will cause the Downlink and Uplink browsers to open.



Figure 2-1: Login Dialog

### **3 WITS Browsers**

Interaction in WITS is done within WITS browsers. There are two primary WITS browsers: the Downlink Browser and the Uplink Browser. The Uplink and Downlink browsers automatically open when a user logs into WITS. The Downlink browser is shown in Figure 4-1 in Section 4 and the Uplink browser is shown in Figure 6-1 in Section 6.

WITS browsers have a selection tree on the left and a work area on the right.

## 4 Downlink Browser

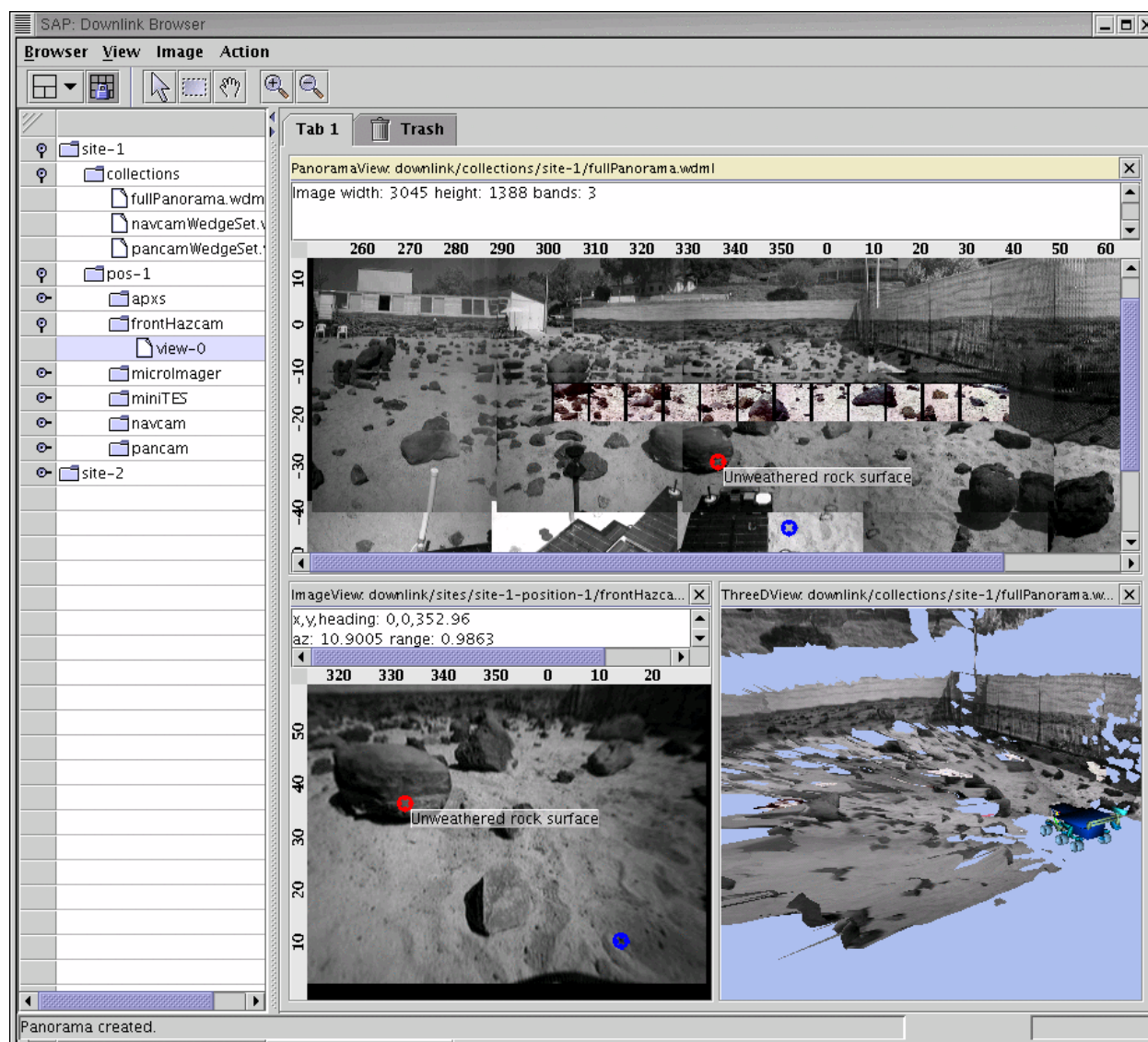


Figure 4-1: Downlink Browser for Data Visualization

The downlink browser (Figure 4-1) is used to select and view downlink data products. Just like a web browser can have a list of bookmarks on the left side of the window and the remaining space is for viewing a web page, the downlink browser arranges links to data products in a tree on the left and creates a view when a link is selected.

### 4.1 Select and Open a Data Product

The downlink selection tree on the left of the downlink browser contains all of the data products in the rover database. The tree is arranged initially by site, position, and instrument name. The tree may be reorganized by



selecting the *Browser⇒Configure Tree* menu, and choosing from several combinations of sol, site, position, and instrument ordering.

To open a folder in the tree, click on the turnbuckle icon to the left of the folder, and it will expand into the folders and data products that it contains. When you double-click on a data product in a folder, it will open a view of that data. Note: if you right-click on a data product, a popup menu will appear that lets you select from all of the available types of view for that data. For example, if you right-click on an image, you may open it in the image view, image cube view, or 3D view.

Data products from instruments like the Microscopic Imager will be labeled as “set-0”, “set-1”, etc. Image data products that are parts of a panorama are named “wdg-0”, “wdg-1”,... where “wdg” is short for “wedge”, or a section of a panorama. Image data products that are from the Navcam or Pancam that are not part of a panorama are labeled “view-0”, “view-1”, ... since these are individual observations.

The collections folders in the tree contain groups of data products, like all of the images in a panorama. When collection data products are viewed, all of the data that is in the collection is shown in a single view, like the panorama view or the 3D view.

## 4.2 Configure the Downlink Browser

As you select data products from the tree to view, they appear in the area called the view grid. At first, the view grid takes up all the space in the browser except for the tree. (You can even hide the tree by dragging the bar that separates it from the view grid to the left.) You can change the *topology* of the grid, partitioning up the viewing area into several parts, by selecting a topology option from the *Browser⇒View Grid Topology* menu, at any time. There are various topologies to choose from, such as 1 by 1, 2 by 2, and 1 over 2. When the view grid has multiple view panes, each new view that you open will appear in one of the empty panes. When there are no more empty panes, the least recently used pane will be re-used, and any view that was there will be sent to the Trash tab (explained in detail in the next section). If all the views are occupied and you want to open a view in a specific pane, close the view in that pane by clicking the “X” icon at the upper right of the pane, then open the view, and it will appear in the pane you just emptied.

### 4.2.1 Tabs

At first, the downlink browser has two tabs: “Tab 1” and “Trash”. Tabs are very useful for opening lots of different views at once that you can flip through one at a time. To create a new tab, right-click on the tab area above the view grid and select *Insert New Tab*, and a new tab will appear that you can open views in. You can flip between tabs by clicking on each tab, and you can add as many tabs as you need. You can also rename each tab with a new name to help you remember what is there, like “Pancam Panorama” or “Site-2 3D View”

The Trash tab is a special tab: it is where views go temporarily when they are closed or replaced by new views. If you open a new view on top of an old view and want to get your old view back, you can go to the Trash tab. The Trash tab holds onto the four most recently closed or replaced views, and when the Trash fills up, the oldest views are removed.

## 5 Targets

In order to command the rover to drive to or place an instrument on a particular location in the world, you can create targets. Targets are 3D locations in the world that you can select from stereo image pairs that come from the Hazcam, Navcam or Pancam instruments. If you haven't already, open a view of one of the front Hazcam or Navcam images from the downlink browser tree. When you click on an image in an image view or panorama view, WITS will try to look up the range of the point in the image where you click. If there is range for the point, then after you click you will see a circular blue annotation or *glyph* where you clicked (see Figure 4-1). (Glyphs are annotations that are drawn on top of images, like the blue circle that you see when you click in an image, or targets that you name.) Sometimes there will not be any range at a point that you click on in an image, which happens when the automatic stereo correlation cannot locate that point in both the left and right images. This means that often near the boundaries of an image, and even in the middle depending on how far away the objects in the image are from the rover, there may not be range. If there is range, a blue circle will appear in the view where you clicked and also in every other open view that contains that location.

If the blue circle appears after you click in the image, then you can create a target at that point. To do so, select the *Action⇒Add Target* menu item. Next, a dialog prompt will appear where you may enter a name for the target. Target names can be anything, and are usually a short description of why a place is interesting in a particular image, like a "White rock" where you want the rover to take an image, or "sandy clearing" where you want the rover to drive. After you enter the name, a red circle labeled with your target's name will appear in the current view and also in all other views that contain the target. (See Figure 4-1 where a target called "Unweathered rock surface" is shown.)

When you have created one or more targets for the rover to act on, they will also appear listed in the targets view of the uplink browser, which is where you can create your activity plan for the rover to execute. The uplink browser is described in the next section.

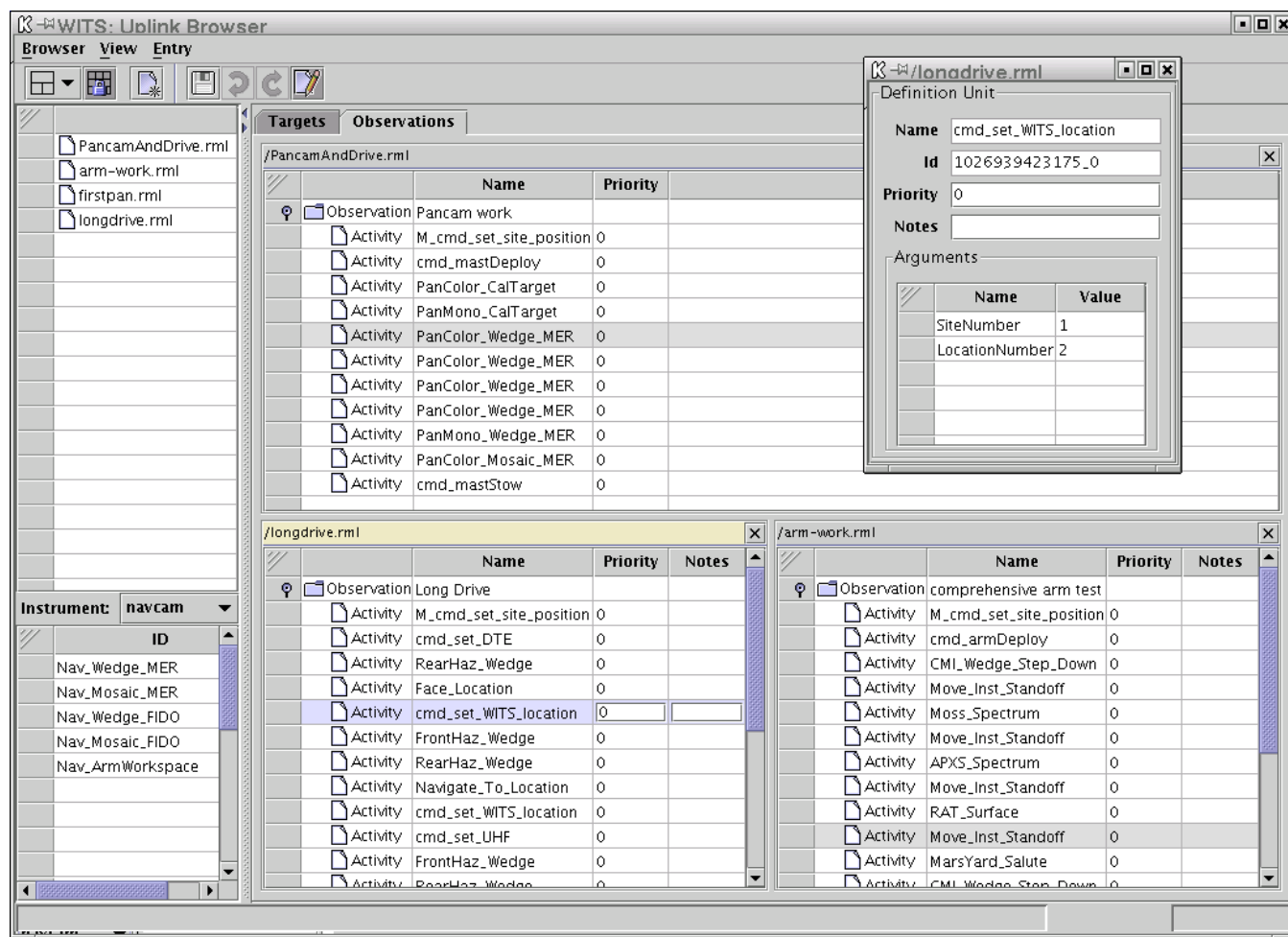


Figure 6-1: The WITS Uplink Browser

## 6 Uplink Browser

The Uplink Browser is used to create and edit activity plans. Activity plans consist of targets, observations, and activities, and are stored in the Rover Markup Language (RML) format.

### 6.1 Overview of the Uplink Browser

#### 6.1.1 The Selection Tree

The left side of the Uplink Browser is an uplink selection tree that allows the user to load a previously saved RML plan. This selection tree is often organized by sols and theme groups. To open a plan from the selection tree, double-click on it. WITS ships with several pre-built plans that you can load.

### 6.1.2 The View Grid

The right side of the Uplink Browser is a WITS view grid. Like the Downlink Browser's view grid, this area can be arranged in a variety of ways by clicking on the first (furthest-left) icon on the toolbar and selecting a topology. By default, the view grid is configured to show just one plan at a time.

The tabs above the view grid allow the user to view the different sections of the currently open plans. Currently there are two tabs: "Targets" and "Observations", but more will be added in the future. Note that these tabs change the currently viewed section for *all* open plans. For instance, figure 6-1 shows an uplink browser that has three plans loaded. One plan is occupying the top half of the browser's view grid and two plans are splitting the bottom half. While the user has the observations tab selected, the defined observations for these three plans are displayed in the browser. If the user clicks on the targets tab, the targets defined for each of these three plans will be displayed instead. Note that the arrangement of the plans in the view grid stays the same on different tabs, so the top area will always represent the same plan, regardless of what tab is currently selected.

When the user clicks within a plan in the view grid, its title bar turns yellow and that plan becomes WITS' currently selected plan. When a plan is selected, its glyphs are displayed in the downlink views.

### 6.1.3 The Details Dialog

When the user clicks on an item within a plan (for instance, an activity), details on that item are displayed in a smaller floating window called the details dialog (see figure 6-2). The details dialog allows the user to edit attributes of the currently selected item. The details dialog can be shown and hidden using the icon on the Uplink Browser toolbar that looks like a piece of paper and a pencil.

### 6.1.4 The Targets Tab

The targets tab in the Uplink Browser shows the targets that have been defined for the currently open plans. Targets are built within downlink views (see section 5), but can be viewed and edited in the Uplink Browser. The targets listed in the targets tab can be used as arguments to activities built within that plan. Note that target glyphs are displayed in the downlink views for the targets in the currently selected plan.

### 6.1.5 The Observations Tab

Activity plans are built within the observations tab of the Uplink Browser. When the observations tab is selected, the activity dictionary appears in the bottom left corner of the Uplink Browser (see figure 6-3). These activities can be added to the currently selected plan by double clicking on them.

## 6.2 Building an Activity Plan: Step by Step Instructions

Below is a list of instructions that you can follow to build a simple activity plan within WITS.

### 6.2.1 Step 1: Create a new plan

Start a new plan by clicking the new plan button on the Uplink Browser toolbar (it looks like a piece of paper with an asterisk in the lower right corner). This will replace the least recently used cell of the view grid with a new plan and make the new plan the selected plan (its title bar will turn yellow). Your plan should look like figure 6-4.

The screenshot shows a software window titled "PancamAndDrive.rml". Inside, there is a "Target" section with the following fields:

- Name:** rock-middle
- Id:** 1026936939637\_0
- Custodian:** Jeff
- Notes:** (empty)
- Creation Date:** 07/17/2002 13:15:39
- Feature:** (empty)
- Motion Counter:** 1,1
- Frame:** ROVER

Below the Target section is an "Image Position" section (empty).

Next is a "Position" section with three fields:

- X:** 2.087
- Y:** 0.861
- Z:** -0.191

Below Position is a "Normal" section with three fields:

- X:** -0.011
- Y:** -0.025
- Z:** -1

At the bottom is a "Direction" section (empty).

Figure 6-2: The details dialog, showing information on a target

Instrument: <b>hazcams</b> ▼	
///	ID ▲
	FrontHaz_Wedge
	RearHaz_Wedge
	Belly_Wedge
	cmd_FrontHazcam
	cmd_RearHazcam
	cmd_BellyCam

Figure 6-3: The activity dictionary, displayed in the lower left corner of the Uplink Browser

Unsaved				✕
///	Name	Priority	Notes	
	📄 Observation			

Figure 6-4: Contents of a brand new plan

	Name	Priority	Notes
Observation			
Activity	FrontHaz_Wedge	0	
Activity	RearHaz_Wedge	0	
Observation			
Activity	Nav_Wedge_MER	0	

Figure 6-5: Observations for a plan with a few activities added

### 6.2.2 Step 2: Add observations and activities

Switch to the observations tab of the Uplink Browser. You should see a single observation in the plan. If you click on the observation, its details will appear in the details dialog (if you have closed the details dialog, you can open it again by clicking on the icon that looks like a piece of paper and a pencil on the toolbar). You will notice that the “Name” and “Custodian” fields in the details dialog are red. Fields that are red are required, so fill in a name and a custodian. Note that you don’t have to press “Enter” to commit a change to a field in the details dialog. As soon as your cursor leaves the field, your modification will be automatically applied.

Time to add an activity! Make sure that your Observation is highlighted and find the activity dictionary in the bottom left corner of the Uplink Browser. Above the list of activities is an “Instrument” pull-down menu that allows you to change between the different activity types available for FIDO. Select “hazcams” and all of the activities that control FIDO’s hazard cameras will be displayed. Double click on “FrontHaz\_Wedge”. This should cause a new activity to be built as a child of the currently selected observation. If nothing appeared beneath the currently selected observation, select the observation again and double click on “FrontHaz\_Wedge” again. Next, double click on “RearHaz\_Wedge”. You should now have two activities in your current plan. You can view the details for these activities in the details dialog by clicking on them.

You can add a new observation by selecting your existing observation and then right-clicking on it. A menu will be displayed- select *Insert After*⇒*Observation*. Try adding a Nav\_Wedge\_MER activity to this new observation (Nav\_Wedge\_MER is in the “navcam” section of the activity dictionary - recall that you select dictionary sections by clicking on the “Instrument:” pulldown menu above the activity list in the bottom left corner of the Uplink Browser. When you’re done, your plan should look like figure 6-5.

### 6.2.3 Step 3: Editing activity arguments

All activities are added with default argument values, but you will often want to modify these defaults. This is accomplished using the Details Dialog. For example, the Nav\_Wedge\_MER activity you added needs a target to work properly. Follow the procedure in section 5 to add a couple of targets to the plan and then highlight the Nav\_Wedge\_MER activity. Click to the right of the “Location” argument. A pull-down menu should appear with the names of all of the targets in the plan. When you select one of these targets, the Nav\_Wedge\_MER activity is modified to point at that target.

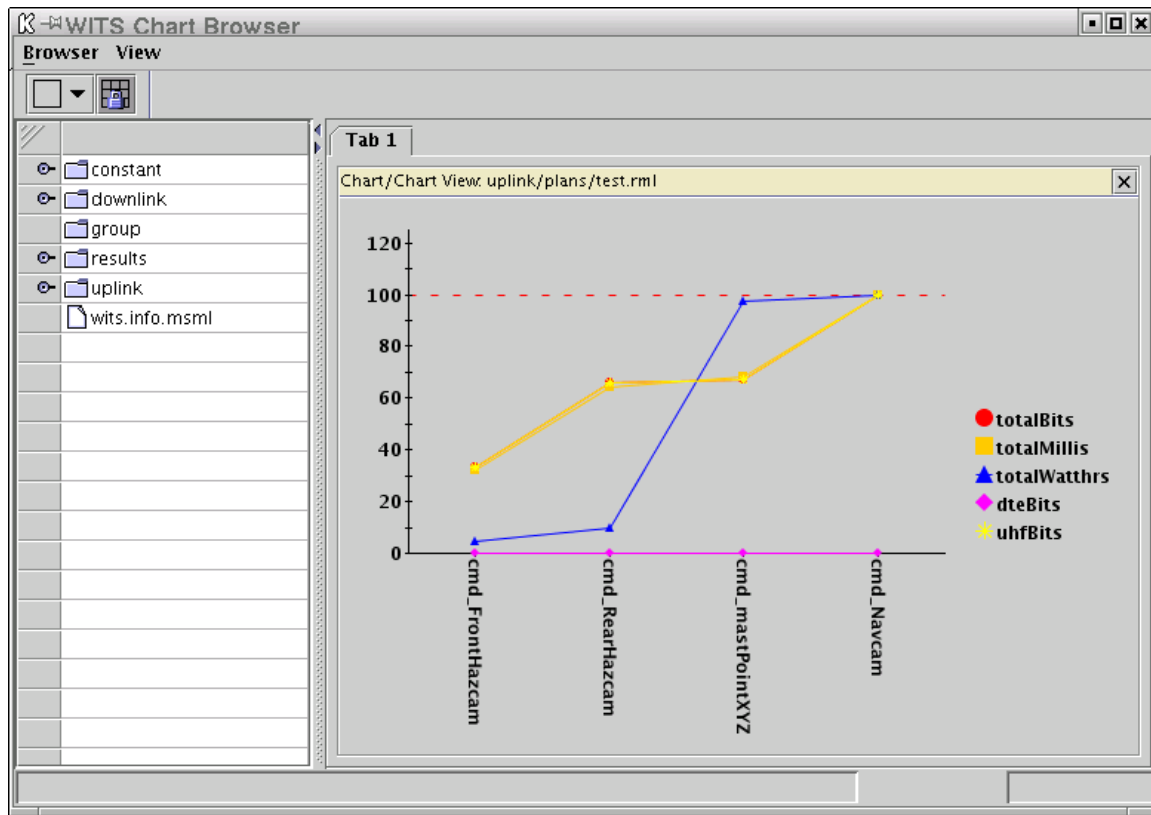


Figure 6-6: The WITS Chart Browser, showing resources used by a plan

#### 6.2.4 Step 4: Saving the plan

So far, you haven't saved your work. To do this, click the save button on the Uplink Browser toolbar (it looks like a little disk). A window will appear that will allow you to choose where to put your plan and what to call it. This window defaults to the top of the plan database, which is a fine place to save your plan. Type in a name (you don't need to include the .rml extension) and click "save". Now, click in the grey area at the top of the selection tree on the left side of the Uplink Browser. Your plan should appear in the selection tree. (Don't worry, it will appear automatically in future versions of WITS). From now on, if you click the save button you will save to the same file.

#### 6.2.5 Step 5: Plotting resources

You can chart the resources that will be used by the plan you have built. Make sure that your plan is selected (its title bar should be yellow) and select "Chart Resources" from the "View" menu at the top of the Uplink Browser. This will open the WITS Chart Browser, a new window (see figure 6-6). Resize and reposition this window so that it doesn't occlude your plan. As you add, modify, and remove activities from your plan, the chart browser will update to reflect the current resources used by the plan. More details on how to use the WITS chart browser will be included in future versions of this document.



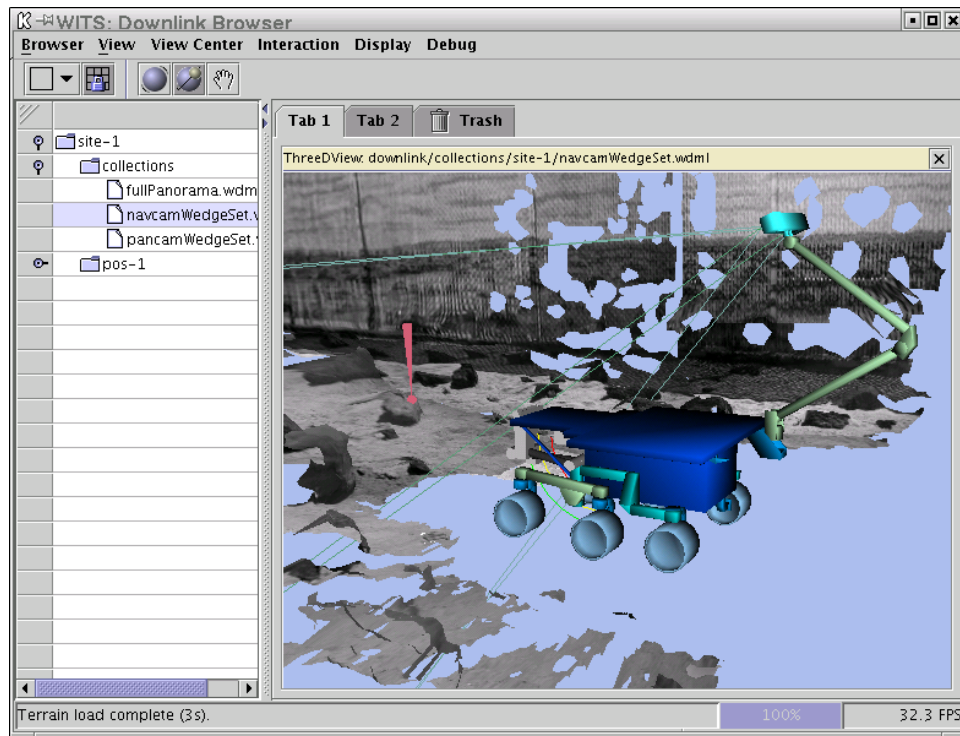


Figure 6-7: A Nav\_Wedge\_MER activity being click-simulated in the 3d view

### 6.2.6 Step 6: Click simulation of the plan

When you click on an activity in a plan, WITS will show you what it expects the state of the rover to be at the conclusion that activity in the plan. This is an invaluable tool for validating and understanding an activity plan. Open a 3d view of a navcam collection in the downlink browser (see section 4) and position the downlink and uplink browsers so that you can see both the plan you are working on in the Uplink Browser and the rover in the 3d view within the Downlink Browser. Click on each activity in the plan you have created. As you click on the activities, you should see changes within the 3d view. For instance, when you click on the Nav\_Wedge\_MER activity, the rover mast should deploy and point at the target you selected in the activity, as shown in figure 6-7. You'll also notice that viewcones turn on in the 3d view to indicate when a particular instrument is being used. WITS shipped with several plans that demonstrate how other activity types are simulated. After you have completed this tutorial, try opening some of these plans and clicking through them to see what the rover is being told to do.

### 6.2.7 Step 7: Activity glyph visualization

Some activities create special objects in WITS called "glyphs". Glyphs are used for a variety of purposes, one of which is to indicate the expected result of a particular activity. In particular, most imaging activities produce image footprint glyphs in the panorama view. To see an example of an image footprint glyph, open a navcam collection in the panorama view within the downlink browser (see section 4). If you have the plan that you build above selected, you should see a yellow rectangular outline around the target that you specified to the Nav\_Wedge\_MER activity, as shown in figure 6-8. This outline indicates the area that will be included in the

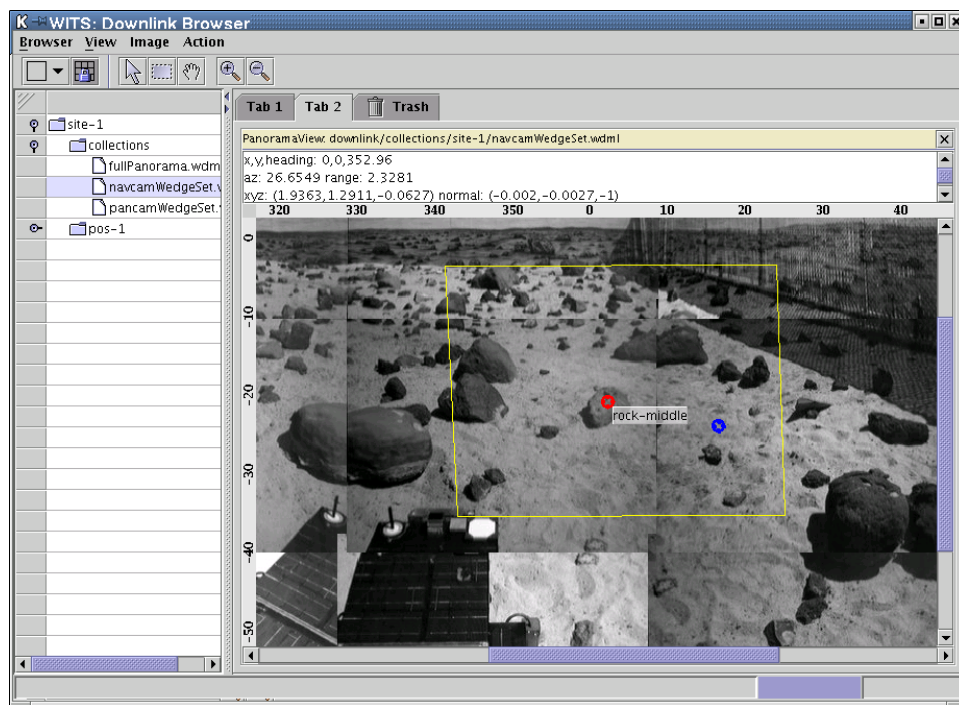


Figure 6-8: A Nav\_Wedge\_MER activity's image footprint in the panorama view

image if the Nav\_Wedge\_MER activity is executed as it is currently specified. Similar footprints are created for the FIDO pancam and IPS (Infared Point Spectrometer) instruments.

## 7 Panorama View

The panorama view displays a group of images all in one view (see Figure 4-1, top). The images are automatically positioned in the panorama according to the position from which they were taken from the rover, resulting in a image collage. In this view, you can select and query any point in any of the images with the mouse, run a large variety of image enhancement operators, and create targets for an activity plan. The panorama view operates very much like the image view, which has only a single image, but offers the same capabilities.

### 7.1 Viewing the panorama and selecting points

To select or query points in the panorama, you must select *Action⇒Query Pixel* on the menu, or click on the arrow toolbar icon. As you click and drag in the image, the point you are currently selecting is described in the text area just above the image. This area shows the x,y,z position, azimuth and range, if any, or tells you if there is “No range” available at the point. When there is range available, if the mouse button is released, a blue circle glyph, or *point of interest* will appear in the view at that point and also in all other views that contain that point. When you need to create a target, you may do so after the point of interest is selected by selecting *Action⇒Add Target* from the menu.

To zoom in or out of the image, select one of the zoom levels from the *Action⇒Zoom* menu. There are various zoom levels available, ranging from 12.5% to 800%. You can also zoom in or out to the next lowest or highest zoom level by clicking on the “+” or “-” magnifying glass icons on the toolbar.

There is a region select mode that you can enter by selecting *Action⇒Select region* from the menu or clicking on the dotted rectangle button on the toolbar. This currently allows you to define a region, and in future releases will help you define activities over a region in the panorama.

You can scroll the image in any direction by selecting *Action⇒Pan* from the menu, or the hand cursor on the toolbar. In pan mode, if you click and drag in the image, the image will move in the direction that you drag. You can also pan the image with the scrollbars.

### 7.2 Image Enhancement

The remaining image operations, such as Anaglyph, Define Bands, Filtering, etc. will be explained in further detail in the next version of this document.

## **8 3D View**

The 3D view provides a fully interactive display of the rover, terrain, targets, etc., taking full advantage of modern 3D graphics accelerators. It is highly recommended to use this view only on computers with a 3D accelerated graphics card installed.

### **8.1 Navigation**

The currently available navigation modes in the 3D view are orbit, spin, and slide. In orbit navigation, you can rotate, zoom, and pan the view. To rotate, drag the mouse using the left button, or use the up, down, left and right cursor keys. To zoom, drag up or down with the middle mouse button. On machines without a middle mouse button, hold the “Alt” or “Meta” key while you drag the mouse with the left button. You can also zoom with the cursor keys by holding down “Alt” or “Meta” and pressing cursor up or down. To pan, drag the mouse with the right mouse button, or while pressing the “Ctrl” key if your mouse does not have two buttons. You can also pan by pressing “Ctrl” and one of cursor up, down, left, or right.

The remaining navigation options in this view will be described in detail in the next version of this document.

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